International Journal of Plant Protection, **Vol. 1 No. 2 : 33-37 (Oct. 2008)**

Seasonal incidence and management of pea leaf miner *Phytomyza horticola* Goureau infesting pea

HARENDRA SINGH AND L. SARAVANAN

Accepted : ***July, 2008***

See end of the article for authors' affiliations

Correspondence to:

L. SARAVANAN
Department of Plant Protection, Allahabad Agricultural Institute (Deemed University), ALLAHABAD (U.P.) INDIA

ABSTRACT

Studies on the seasonal incidence and management of pea leaf miner *Phytomyza horticola* Goureau (Agromyzidae:Diptera) infesting pea (*Pisum sativum*. L.) were carried out during December 2005- April 2006 at Agricultural Research farm at Allahabad Agricultural Institute-Deemed University Allahabad. The pea Leaf miner commenced from 2nd week of February with an average population of 7.3 leaf miner per plant Leaf miner population gradually increased and reached its peak level of 9.25 leaf miner per plant during 4th week of February(9th Standard week). It was found that pea leaf miner increased with increasing maximum temperature, slight rainfall and morning relative humidity and decreased with increasing minimum temperature, evening relative humidity, wind velocity and sunshine hours. Among the insecticides treated, imidacloprid gave 100 per cent population reduction at five days after spraying. All other treatments *viz*., acetamiprid (99.11%) acephate (98.97 %), profenophos (98.93 %) thiomethoxam (97.35%), NSKE (97.35%), endosulfan (96.95%) alphamethrin (96.77%), and neem oil (91.41%) were found to be statistically at par with each other in managing this pest.

Key words : Pea leaf miner, *Phytomyza horticola,* Seasonal incidence, Management.

Pea (*Pisum sativum* L.) is an important grain legume crop in India and mostly cultivated during *rabi* season. In India, it is cultivated on 0.73 million ha with annual production of 0.72 million tonnes and with an average productivity of 906 kg/ha. The leaf miner, *Phytomyza horticola* is an important insect pest of pea throughout the pea growing areas. It is often severe in the states of Bihar, Delhi, Madhya Pradesh, Orissa, Punjab, Uttar Pradesh, West Bengal and Himachal Pradesh (Jha and Singh, 1994; Sharma *et al.*, 1994).

The larvae are more injurious which feed on leaf tissue and form galleries leaving intact the epidermal layer. In case of severe attack entire leaf is filled with the mines and 86-93 per cent of the leaves are found affected (Atwal *et al.*, 1969). The destruction of the chlorophyll containing tissue interferes with the photosynthetic activity of the plant as a result of which the growth and yield of the infested plant is adversely affected (Vishwanath and Agrawal, 1982). Bijjur and Verma (1995) observed that the population of leaf miner pupa per plant in the 1991-92 and 1992-93 continued to build up with decrease in temperature and attained a peak of 19.88 and 19.14 pupae per plant at flowering stage during last week of December in both years, respectively. Later on with rise in temperature along with the maturity of the crop, population showed decreasing trend. The studies on the effects of various insecticides have been undertaken by Singh *et al*. (1986), Pandey *et al.* (1993) and Sharma *et al.* (2003). However, very little information is available on seasonal incidence and management of pea leaf miner in this region.

MATERIALS AND METHODS

Studies on the "Seasonal incidence and management of pea leaf miner, *Phytomyza horticola* Goureu infesting pea (*Pisum sativum*. L)" was carried out during December 2005 to April 2006 at Agricultural Research Farm at Allahabad Agricultural Institute-Deemed University, Allahabad, Uttar Pradesh. This investigation was carried out on "Arpana" a pea variety. All the recommended agronomic practices were followed to raise the crop except plant protection measures, which enable the build up of insect pests and their natural enemies in a pesticides free environment.

Studies on the seasonal incidence of pea leaf miner:

The observations on the population build up of pea leaf miner, *P. horticola* were recorded from 15 days after sowing till harvest. For recording pest population total number of larvae and pupae of the insect were counted on five leaves from each of the five random selected plants per plot and average population per five leaves per plant was worked out.

The data on maximum and minimum temperature, relative humidity, rainfall sunshine hours and wind velocity were collected from the University meteorological observatory located close to the experimental site. They

were correlated with the population of pea leaf miner.

Management of pea leaf miner P. horticola:

In order to evaluate the bio-efficacy of acephate, profenophos, alphamethrin, endosulfan, acetamiprid, inidacloprid, thiomethoxam, neem oil and neem seed kernel extract (N.S.K.E.) against pea leaf miner, an experiment on pea was laid out in a randomized block design (R.B.D.) with ten treatments including untreated check and replicated thrice. The plot size of each treatment was 2.0 m x 1.5 m. The treatments were imposed when there was peak infestation of pea leaf miner. For recording the population levels of leaf miner, five leaves on each plant were selected randomly and labeled. A total of five plants per plot were determined for each replication. The pre determined quantity of each insecticide was applied thoroughly using manually operated foot sprayer. The pre treatment count of number of larvae present within mines or blistered patches were recorded 24 hours before application of insecticides. The post treatment count of number of dead larva were recorded at one, three and five days after treatment.

Statistical analysis:

The percentage population reduction in different treatments over control was calculated from post treatment data on larvae population of pea leaf miner by using modified Abbots formula as given by Fleming and Retnakaran (1985).

$$\% \text{ population reduction} = 1 - \frac{\text{Post-treatment population in treatment}}{\text{Pre-treatment population in treatment}} \times \frac{\text{Pre-treatment Population in check}}{\text{Post-treatment Population in check}} \times 100$$

The percentage population reduction values were duly transformed in to the corresponding angular values and were subjected to analysis of variance. Critical difference (CD) was applied for comparing treatment means (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Seasonal incidence of pea leaf miner, P. horticola:

Studies on the incidence of pea leaf miner with the weather parameters are given in Table 1. The incidence of pea leaf miner, *P. horticola* on pea during *rabi* season 2005-2006 commenced from 2nd week of February (6th

Table 1 : Correlation between pea leaf minor *Phytomyza horticola* and weather parameters during crop period, December 14-April 8, 2005-06

Sr. No.	Standard week	Date	No. of pea leaf miner/plant	Temperature ^{0}C		R.H. (%)		Rain fall (mm)	Wind velocity (k/hr)	Sunshine (hr/day)
				Max	Min	Morning	Evening			
		December								
1.	50	10-16	0	25.3	7.2	88	25	0	1.17	8.3
2.	51	17-23	0	24.5	5	92	35	0	1.21	6.3
3.	52	24-31	0	25.1	5.5	89	33	0	2.1	6.0
4.		January								
	1	1-7	0	26.04	6.6	92	37	0	1.92	7.4
5.	2	8-14	0	24.05	4.18	92	37	0	1.4	8.4
6.	3	15-21	0	28.15	8.52	93	31	0	2.08	8.1
7.	4	22-28	0	25.85	7.38	92	34	0	1.81	8.3
8.		Feb.								
	5	29-4	7.3	28.5	8.6	91	31	0	3.8	8.7
9.	6	5-11	8.14	29.2	11.2	85	33	0	1.78	6.5
10.	7	12-18	8.06	30.05	12.2	85	28	0	2.2	9.2
11.	8	19-25	9.25	34.8	13.7	74	25	0	3.08	10.1
12.		March								
	9	26-4	7.5	33.8	15.7	70	26	0.1	3.07	8.4
13.	10	5-11	4.33	31.3	15.3	77	43	0	2.87	4.9
14.	11	12-18	1.83	30.1	15.5	84	40	0	2.4	7.0
15.	12	19-25	0.5	35.2	15.4	89	17	0	2.58	0.6
16.	13	26-1	0	37.2	16.9	66	16	0	2.33	8.9
17.		April								
	14	2-8	0	40.5	18.3	63	14	0	1.8	8.9
			r	0.226272	-0.45086	0.214647	-0.71935	0.258879	-0.28821	-0.06529
			t	0.82514	-1.9494	0.78525	-0.3034	-1.0696	-1.1992	-0.2571
				NS	NS	NS	S	NS	NS	NS

Standard week) with an average population level of 7.3 leaf miner per plant. The leaf miner population gradually increased and reached its peak level of 9.25 leaf miner per plant during 4 th week of February (9th Standard week). There after declined trend was observed and population of pea leaf miner reached its lowest level of being an average 0.5 leaf miner per plant during 4th week of March (12th standard week). The incidence of *P. horticola* was observed from February 2nd week till 4th week of March 2006. Srivastava and Singh (1972) also reported maximum population of leaf miner of pea in February and March. The findings of Deshraj *et al*. (1995) also more or less confirmed the results of the present investigation, who found that maximum infestation was during the 4th week of February. The pre-ponderence of *P. horticola* might be due to moderate temperature and other climatic factors prevailed during the study as well as succulent foliage available during that time.

Studies on correlation of pea leaf miner population with weather parameters revealed that the pea leaf miner population exhibited non –significant, positive correlation with maximum (r= 0.226) and non-significant negative correlation with minimum temperature (r=–0.450), non-significant positive correlation with morning relative humidity (r= 0.214) and significant negative correlation with evening relative humidity (r=0.719). Wind velocity and sunshine hours showed non-significant negative correlation (r=-0.288 and –0.065), respectively. However, rainfall showed non-significant positive correlation (r=0.258). Thus the studies indicated that the leaf miner population increased with increasing maximum temperature, slight rainfall and morning relative humidity and decreased with increasing minimum temperature, evening relative humidity, wind velocity and sunshine hours. The declining of pest infestation might be due to maturity and drying of plants as reported by Singh (1984), increase in temperature in march 2nd week onwards as reported by Brar and Sandhu (1976). Rai and Ram (1997) reported that weather parameters appeared to be the major regulatory factors for leaf miner infestation under field conditions.

Management of pea leaf miner P. horticola:

The efficacy of different insecticides are depicted in Table 2.

One day after spraying:

The data on the population reduction of *Phytomyza horticola* over control on first day after spraying revealed that all the chemical treatments were significantly superior to control. Among all the treatments highest per cent larval reduction of *Phytomyza horticola* was recorded in acetamiprid (81.16%) followed by endosulfan (80.73%).

Table 2: Efficacy of some insecticides against pea leaf miner *Phytomyza horticola* during *rabi* season, 2005-06

Sr. No.	Treatment	Concentration used (%)	Pre-treatment population	Percent reduction over control		
				1st Day	3rd Day	5th Day
1.	Acephate	0.1	5.86	74.33	89.86	98.97
				(59.54)	(71.47)	(83.98)
2.	Profenophos	0.05	5.26	76.63	85.89	98.93
				(61.07)	(67.94)	(83.98)
3.	Alphamethrin	0.03	5.60	77.12	94.30	96.77
				(61. 41)	(76.19)	(79.69)
4.	Endosulfan	0.07	7.06	80.73	91.19	96.95
				(63.94.)	(72.74)	(79.86)
5.	Acetamiprid	0.02	6.73	81.16	90.77	99.11
				(64.30)	(72.34)	(84.29)
6.	Imidacloprid	0.03	6.93	80.48	97.16	100.00
				(63.79)	(80.37)	(90.00)
7.	Thiomethoxam	0.05	7.53	77.60	93.86	97.35
				(61.75)	(75.70)	(80.54)
8.	Neem oil	5	6.86	51.95	76.70	91.41
				(46.09)	(61.14)	(72.95)
9.	N.S.K.E.	5	7.00	6086	85.26	97.35
				(51.30)	(67.45)	(80.54)
10.	Control	0	7.20	00	00	00
	F. Test			S	NS	NS
	S.E. $\pm$			2.241	3.297	4.564
	C.D. (P=0.05)			4.709	6.927	9.552

** Figures in parenthesis are transformed Arc-sine value

The data on per cent larval reduction after one day spraying revealed that imidacloprid was statistically at par with endosulfan. Treatments like thiomethoxam, alphamethrin and profenophos were statistically at par in reducing the larval population. NSKE (60. 86%) and neem oil (51.95%) were found to be least effective among the other treatments.

Third day after spraying:

The data on per cent population reduction of *Phytomyza horticola* over control on third day after spraying revealed that all the treatments were superior to control. Among all the treatments highest per cent larval reduction of *Phytomyza horticola* was recorded in imidacloprid (97.16%) followed by alphamethrin (94.30%). Treatments alphamethrin (94.30%), thiomethoxam (93.86%), endosulfan (91.19%) and acetamiprid (90.77%) were found to be at par with imidacloprid (89.86%), profenphos (85.89%)and NSKE (85.26). Among all the treatments neem oil (76.70%) was found to be least effective in reducing leaf miner population. NSKE was found to be at par with endosulfan, acetamiprid, acephate and profenophos.

Fifth day after spraying:

The data on per cent population reduction of pea leaf miner *Phytomyza horticola*, over control on fifth day after spraying revealed that the all treatments were superior over control Imidacloprid gave 100 per cent population reduction. All the other treatments *viz.*, acetamiprid (99.11%) acephate (98.97%), profenophos (98.93%), thiomethoxam (97.35%), N.S.K.E (97.35%), endosulfan (96.95%), alphamethrin (96.77%) neem oil (91.41%) were found to be statistically at par with each other. The effectiveness of acephate (0.07%) and endoslfan (0.05%) in managing other leaf miner namely cashew leaf miner, *Acrocercops syngrama was* reported by Mohapatra *et al.* (1995); and Athalye and Patil (1998). Effectiveness of enduslfan (0.0075%) on pea leaf miner was also reported by Singh *et al.*(1986).

From the present investigation it was observed that pea leaf miner population reached its peak level of 9.25 leaf miner per plant during 4 th week of February (9th Standard week.). The incidence of *P. horticola* was observed from February 2nd week till 4th week of March 2006. It was found that pea leaf miner increased with increasing maximum temperature, slight rainfall and morning relative humidity and decreased with increasing minimum temperature, evening relative humidity, wind velocity and sunshine hours. All the insecticides used in this investigation were found to be effective in controlling this pest. The present investigation may be useful in planning and devising proper pest management strategy for this pest in this region.

Authors' affiliations:
HARENDRA SINGH, Department of Plant Protection, Allahabad Agricultural Institute (Deemed University), ALLAHABAD (U.P.) INDIA

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